FEMI 209:260427

FLOOD INSURANCE STUDY

ORIGINAL

COMPLETED

39

TOWNSHIP OF COMSTOCK, MICHIGAN

KALAMAZOO COUNTY

MAY 17, 1982

Federal Emergency Management Agency

COMMUNITY NUMBER - 260427

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Flood Boundary and Floodway Map

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Flood Insurance Rate Map

FLOOD INSURANCE STUDY

TOWNSHIP OF COMSTOCK,
KALAMAZOO COUNTY, MICHIGAN

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Township of Comstock, Kalamazoo County, Michigan, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the Township of Comstock to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Wade, Trim and Associates, Inc. for the Federal Emergency Management Agency, under Contract No. H-4802. This study was completed in April 1981.

1.3 Coordination

The limits of detailed and approximate studies in the Township of Comstock were determined with community and Study Contractor consultation at a meeting on May 11, 1978. During the course of the study, flood elevations, flood boundaries and floodway delineations were reviewed with community officials and with officials of the Michigan Department of Natural Resources.

The Michigan Department of Natural Resources, Hydrologic Studies Unit, Water Management Division provided information on Comstock Creek and the Kalamazoo River. The U.S. Department of Agriculture, Soil Conservation Service (SCS), provided information on soils in the study area. The Township of Comstock Supervisor provided a Land Use Map for the community. The U.S. Army Corps of Engineers (COE) provided a pertinent report on the Kalamazoo River.

On October 14, 1981, the results of the work by the Study Contractor were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Township of Comstock, Kalamazoo County, Michigan. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through April 1986.

Approximate methods of analysis were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to and agreed upon by FEMA and the Township of Comstock.

The following streams were studied in detail:

a. Kalamazoo River, within the corporate limits, from the downstream corporate limit at Sprinkle Road to the upstream Townships of Comstock and Charleston corporate boundary; and

b. Comstock Creek, from its mouth to Main Street.

Flooding of portions of Comstock Creek and two unnamed depressions located adjacent to the corporate limits of the Township of Kalamazoo near East Main Street were studied by approximate methods.

BEST DOCUMENT AVAILABLE

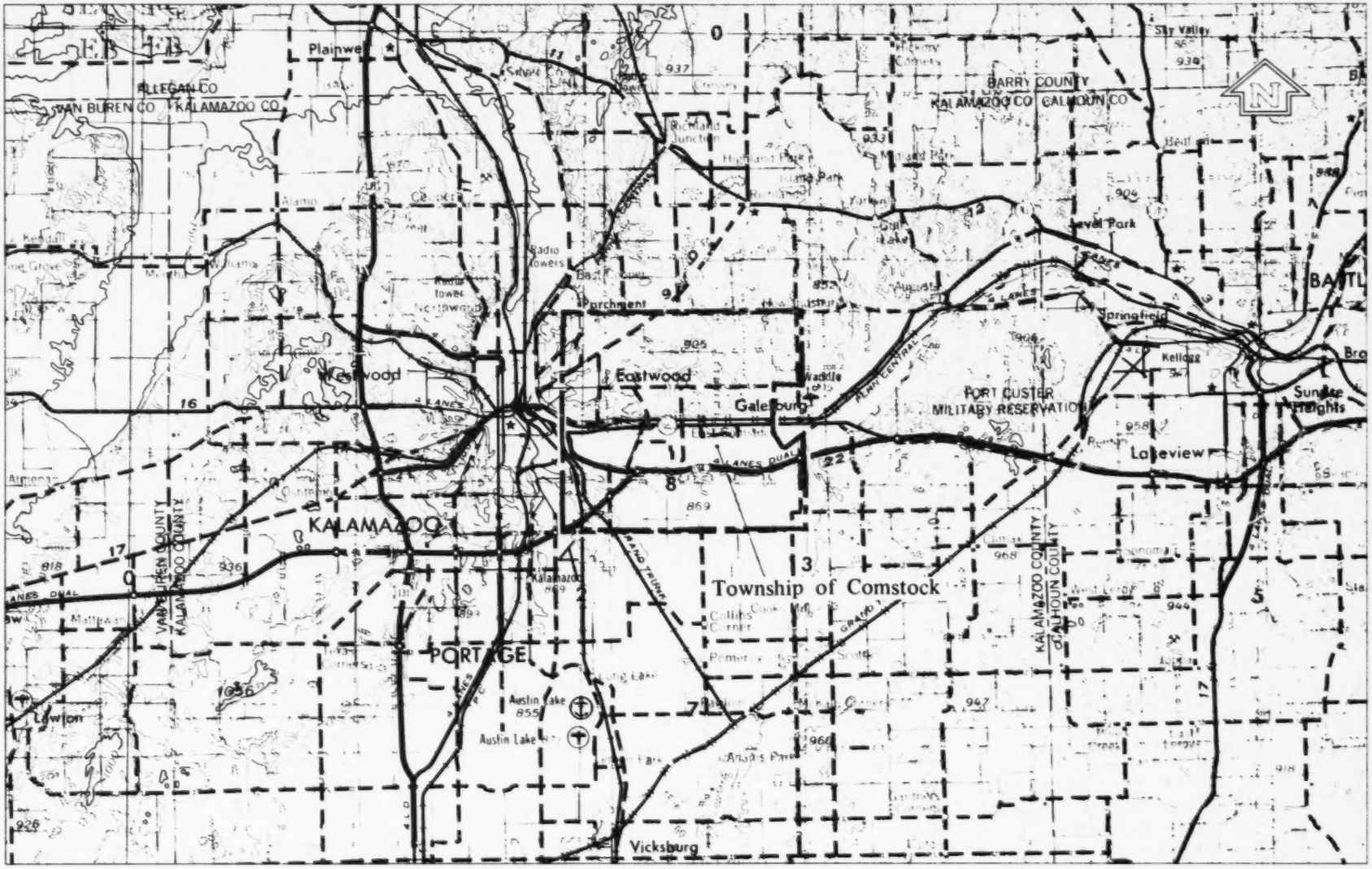

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF COMSTOCK, MI
(KALAMAZOO CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

2.2 Community Description

The Township of Comstock is located in southwestern Michigan in northeast Kalamazoo County, approximately 10 miles northeast of the City of Kalamazoo. The community covers an area of approximately 36 square miles and is bordered on the north by the Township of Richland, on the south by the Township of Pavilion, on the west by the City of Kalamazoo and the Township of Kalamazoo and on the east by the City of Galesburg and the Township of Charleston. The 1970 Census lists the population as 10,465 (Reference 1).

While there are no major climatological stations located in the Township of Comstock study area, there is one located nearby in the City of Kalamazoo (Reference 2). The climate of this area is influenced by Lake Michigan throughout most of the year. The mean annual temperature is 49.7 degrees Fahrenheit with an average frost-free season from approximately May 9 to October 9.

Precipitation is uniformly distributed throughout the year, being just slightly greater during the summer months than during the winter months. Generally, June has the greatest precipitation which averages approximately 3.8 inches, while February has the least precipitation with approximately 1.8 inches. The annual average precipitation is approximately 34 inches. Snowfall in the area averages approximately 70 inches annually (Reference 3).

Soils associated with Comstock Creek Basin generally have undulating to steep slopes, are well drained and have sandy and loamy subsoils. These soils were formed in a glacial outwash and in sandy morainal deposits. Soils associated with the Kalamazoo River basin, within the Township of Comstock, are nearly level, varying from well drained to very poorly drained, and the subsoils are sandy and loamy (Reference 4).

The Township of Comstock is largely a rural, agricultural community characterized by farmlands, woods and open areas. Urbanization including commercial, industrial and residential development has concentrated in the western portion of the community and along the Kalamazoo River. The remainder of development along the Kalamazoo River and Comstock Creek is primarily agricultural.

2.3 Principal Flood Problems

The history of flooding within the Township of Comstock indicates that the main flooding season is during the winter and spring. Floods due to intense local thunderstorms have also been recorded during summer months and may occur at any time.

Combinations of weather and natural circumstances have served to create flooding problems within the township. Flooding may also be anticipated during periods of heavy rainfall or excessive snowmelt.

The gaging station (No. 04106000- 48 years of record) located on the Kalamazoo River at the downstream side of the River Street bridge recorded a peak elevation of 767.06 National Geodetic Vertical Datum (NGVD) for a discharge of 6,910 cubic feet per second (cfs) during the 1947 flood which was equivalent to a 100-year storm.

2.4 Flood Protection Measures

There are no flood protection measures along or across the streams within the Township of Comstock; however, there are a few lakes and ponds along Comstock Creek which serve as retention areas that reduce peak flows during floods. The Morrow Lake Dam, located on the Kalamazoo River, does not serve as a storage reservoir during floods because the lake level is maintained at the same elevation during major floods as during low flow periods, through manipulation of the outlet structure. However, it is important to note that flowage rights have been retained by Consumers Power Company to elevation 783.0 NGVD on all adjoining parcels privately occupied. Therefore, human intervention at Morrow Lake Dam can cause flood levels higher than those shown in profiles and maps.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 per cent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one per cent chance of annual occurrence) in any 50-year period is about 40 per cent (four in ten), and for any 90-year period, the risk increases to about 60 per cent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

The Comstock Creek flood flow frequency analysis was based upon the SCS TR-20 Basin Runoff Modeling Technique (References 5 and 6). This technique utilizes the following parameters in the development of peak flow rates: land use, soil types, topography and precipitation. The precipitation parameter is based upon statistical analyses of historic rainfall records. The SCS technique is considered applicable to the Comstock Creek basin since it is sensitive to varying soil types, predominantly rural land uses and storage within Campbell Lake, located in the upper portion of the basin.

The Kalamazoo River flood flow frequency analysis was based upon a log-Pearson Type III statistical analysis of historic flood levels at the Comstock stream gage, located immediately downstream of the River Street bridge in the Township of Comstock (Reference 7). Gage records from 1932 to 1979 were considered in the analysis.

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
KALAMAZOO RIVER					
At upstream corporate limits	1,035	4,500	6,070	6,750	8,420
At Comstock gage	1,067	4,530	6,090	6,770	8,410
At downstream corporate limits	1,089	4,620	6,810	6,900	8,590
COMSTOCK CREEK					
At mouth	12.5	140	210	250	400

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the streams in the community were carried out to provide estimates of the elevations of the floods of the selected recurrence intervals along each flooding source studied in detail.

Cross sections utilized in the hydraulic analyses of the Kalamazoo River were obtained from a field survey performed in August 1979. Cross sections utilized in the hydraulic analyses of the Comstock Creek were obtained from a field survey performed in March 1980. Cross sections for both streams were supplemented by an aerial survey (Reference 8) and U.S. Geological Survey (USGS) quadrangle maps (Reference 9), which consist of 10-foot contour intervals. All bridges, dams and culverts were field checked to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map.

Roughness coefficients (Manning's "n"), for Comstock Creek, were estimated by field inspection at each cross section. Roughness values varied from 0.030 to 0.040 for the main channel and from 0.08 to 0.10 for the overbanks.

Roughness coefficients for the Kalamazoo River were estimated by field inspection, quadrangle map information (Reference 9) and survey photographs. Roughness values for the main channel were 0.030; roughness values for the overbank areas vary between 0.06 and 0.12 for all floods.

These values are indicative of summer month conditions and are consistent with values recommended and used in engineering practice (References 10 and 11).

Starting water-surface elevations for the Kalamazoo River at Sprinkle Road were taken from the Township of Kalamazoo Flood Insurance Study (Reference 12).

For Comstock Creek, the mean annual water-surface elevation of the Kalamazoo River, located at the mouth of Comstock Creek, was used for the starting water-surface elevation for the hydraulic analysis of the 10-, 50-, 100- and 500-year floods. However, backwater elevations from the Kalamazoo River were plotted on the stream profile, where these elevations exceeded Comstock Creek elevations, to reflect flood conditions from both streams.

The HEC-2 backwater computer program was used in developing water-surface profiles for the Kalamazoo River and Comstock Creek (Reference 13). The HEC-2 computer model was calibrated with the 1947 flood and the high water mark was matched with the 100-year flood profile developed for this Flood Insurance Study.

There is an oxbow in the river between Sprinkle Road and River Street. A rating curve was developed for the oxbow and the main river. Results of this analysis indicated that only one per cent of the 100-year flow would go through the oxbow. This reduction of the flow in the main branch of the river would only reduce the 100-year flood elevation approximately 0.02 feet from the full flow elevation. Therefore, the oxbow has no effect on flood stages and was not included as part of the analysis.

The Morrow Lake Dam was analyzed by hand computations using an orifice equation (Reference 13). The resulting elevations were input to the computer model.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles are, therefore, considered valid only if hydraulic structures, in general, remain unobstructed and if channel and overbank conditions remain essentially the same as ascertained during this study.

All elevations are referenced from National Geodetic Vertical Datum of 1929 (NGVD); elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by FEMA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100-year and the 500-year floods have been delineated using the elevations determined at each cross section; between cross sections the boundaries were interpolated using topographic maps at a scale of 1:24000 and contour interval of 10 feet (Reference 9).

For the streams studied by approximate methods, the boundary of the 100-year flood was developed from the normal depth calculations and the topographic maps referenced above. All Zone A areas were developed from normal depth calculations with an exception of the Zone A area, determined from the Flood Hazard Boundary Map, located south of Comstock Avenue adjacent to the corporate limits of the Township of Kalamazoo (Reference 14).

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map. Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to lack of detailed topographical information or to limitations of the map scale, such areas are not shown. In cases where the 100-year and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. In Michigan though, under Michigan Act 245, Public Acts of 1929, as amended by Act 167, Public Acts of 1968 (Reference 15), encroachment in the flood plain is limited to that which will cause only an insignificant increase (0.1 foot) in flood heights. Thus, at the recommendation of the Bureau of Water Management, a floodway having no more than a 0.1-foot surcharge has been delineated for this study.

The floodways for Comstock Creek and the Kalamazoo River were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2). No floodway was computed around Morrow Lake because Consumers Power Company retains flowage rights on adjoining parcels of land. Also, no floodway was shown on the portion of Kalamazoo River which is outside the Comstock corporate limits.

As shown on the Flood Boundary and Floodway Map, the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
KALAMAZOO RIVER								
A	0	252	2123	3.3	765.5	765.5	765.6	0.1
B	64	252	2129	3.2	765.5	765.5	765.5	0.1
C	1914	383	2351	2.9	766.0	766.0	766.1	0.1
D	2364	213	1625	4.2	766.1	766.1	766.2	0.1
E	3014	236	1706	4.0	766.3	766.3	766.4	0.1
F	3574	242	1642	4.1	766.5	766.5	766.6	0.1
G	4114	394	2420	2.8	767.0	767.0	767.1	0.1
H	4694	146	1656	4.1	767.1	767.1	767.2	0.1
I	4749	146	1498	4.5	767.1	767.1	767.2	0.1
J	5764	638	3164	2.1	767.6	767.6	767.7	0.1
K	8944	643	3317	2.0	768.6	768.6	768.7	0.1
L	10,414	266	2151	3.1	769.0	769.0	769.1	0.1
M	10,460	267	2184	3.1	769.1	769.1	769 2	0.1
N	10,904	380	4775	1.4	769.3	769.3	769.4	0.1
O	11,304	108	1536	4.4	769.3	769.3	769.4	0.1
W	28,437	166/65[2]	1037	6.5	779.3	779.3	779.3	0.0
X	31,812	1166/140[2]	4347	1.6	783.0	783.0	783.1	0.1

[1]FEET ABOVE CORPORATE LIMITS
[2]TOTAL WIDTH / WIDTH WITHIN CORPORATE LIMITS

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF COMSTOCK, MI
(KALAMAZOO CO.)

FLOODWAY DATA

KALAMAZOO RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
COMSTOCK CREEK								
A	100	135	109	2.3	767.6	764.0[2]	764.0	0.0
B	852	13	30	8.3	767.6	766.9[2]	766.9	0.0
C	923	13	43	5.8	768.1	768.1	768.1	0.0
D	1025	54	84	3.0	769.0	769.0	769.0	0.0
E	1485	35	42	5.9	773.5	773.5	773.5	0.0
F	1568	31	39	6.4	775.8	775.8	775.8	0.0
G	1660	31	41	6.1	777.1	777.1	777 1	0.0
H	1750	31	39	6.4	779.1	779.1	779.1	0.0
I	1794	100	310	0.8	791.9	791.9	791.9	0.0
J	2784	48	54	4.6	792.5	792.5	792.5	0.0
K	2864	8	25	10.1	795.3	795.3	795.3	0.0
L	2902	8	38	6.6	796.9	796.9	796.9	0.0
M	2922	42	154	1.6	797.7	797.7	797.7	0.0
N	2957	112	248	1.0	809.8	809.8	809 8	0.0
O	4280	98	221	1.1	810.1	810.1	810.1	0.0
P	5872	77	75	3.3	816.5	816.5	816.5	0.0
Q	7132	25	47	5.3	822.9	822.9	822.9	0.0
R	7800	210	339	0.7	824.4	824.4	824.4	0.0
S	7990	209	450	0.6	824.4	824.4	824.4	0.0

[1]FEET ABOVE MOUTH
[2]ELEVATIONS WITHOUT CONSIDERING BACKWATER EFFECT FROM KALAMAZOO RIVER

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF COMSTOCK, MI
(KALAMAZOO CO.)

FLOODWAY DATA

COMSTOCK CREEK

BEST DOCUMENT AVAILABLE

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 0.1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

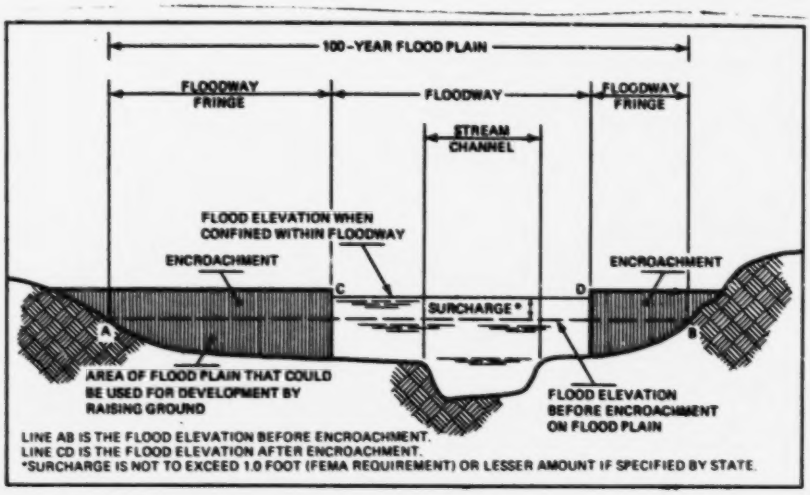
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FIGURE 2 - Floodway Schematic

The floodways in this report are recommended to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, FEMA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF), and flood insurance zone designations for each flooding source affecting the Township of Comstock.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 per cent of the reach.

Average Difference Between 10- and 100-year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the Township of Comstock are shown on the Flood Profiles and are summarized in Table 3, "Flood Insurance Zone Data."

5.2 Flood Hazard Factors

The FHF is used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the Township of Comstock was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations are shown or FHFs determined.
Zones A1, A3, A4:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations are shown, and zones subdivided according to FHF.

Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; or areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Township of Comstock is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by FEMA.

6.0 OTHER STUDIES

Flood Insurance Studies are currently being conducted for the City of Kalamazoo, the Township of Kalamazoo and the City of Galesburg (References 16, 12 and 17). The results of the Comstock study will match exactly the above Flood Insurance Studies. In the City of Charleston study (Reference 18), the water-surface elevations and 100-year flood plain match; however, no floodway or 500-year flood plain is shown in Charleston.

A Flood Hazard Boundary Map has been published for the community (Reference 14). The differences between the Flood Hazard Boundary Map and this study are justified due to the more detailed nature of this Flood Insurance Study.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the National Flood Insurance Program.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, 300 South Wacker Drive, (24th Floor), Chicago, Illinois 60606.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
KALAMAZOO RIVER							
REACH 1	0004	–1.9	–0.6	1.5	020	A4	VARIES–SEE MAP
REACH 2	0004,0005,0006 0007,0008,0009	–0.1	–0.0	0.7	005	A1	VARIES–SEE MAP
REACH 3	0006,0009	–1.4	–0.4	0.8	015	A3	VARIES–SEE MAP
COMSTOCK CREEK							
REACH 1	0004	–0.7	–0.2	0.6	005	A1	VARIES–SEE MAP

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF COMSTOCK, MI
(KALAMAZOO CO.)

FLOOD INSURANCE ZONE DATA

KALAMAZOO RIVER - COMSTOCK CREEK

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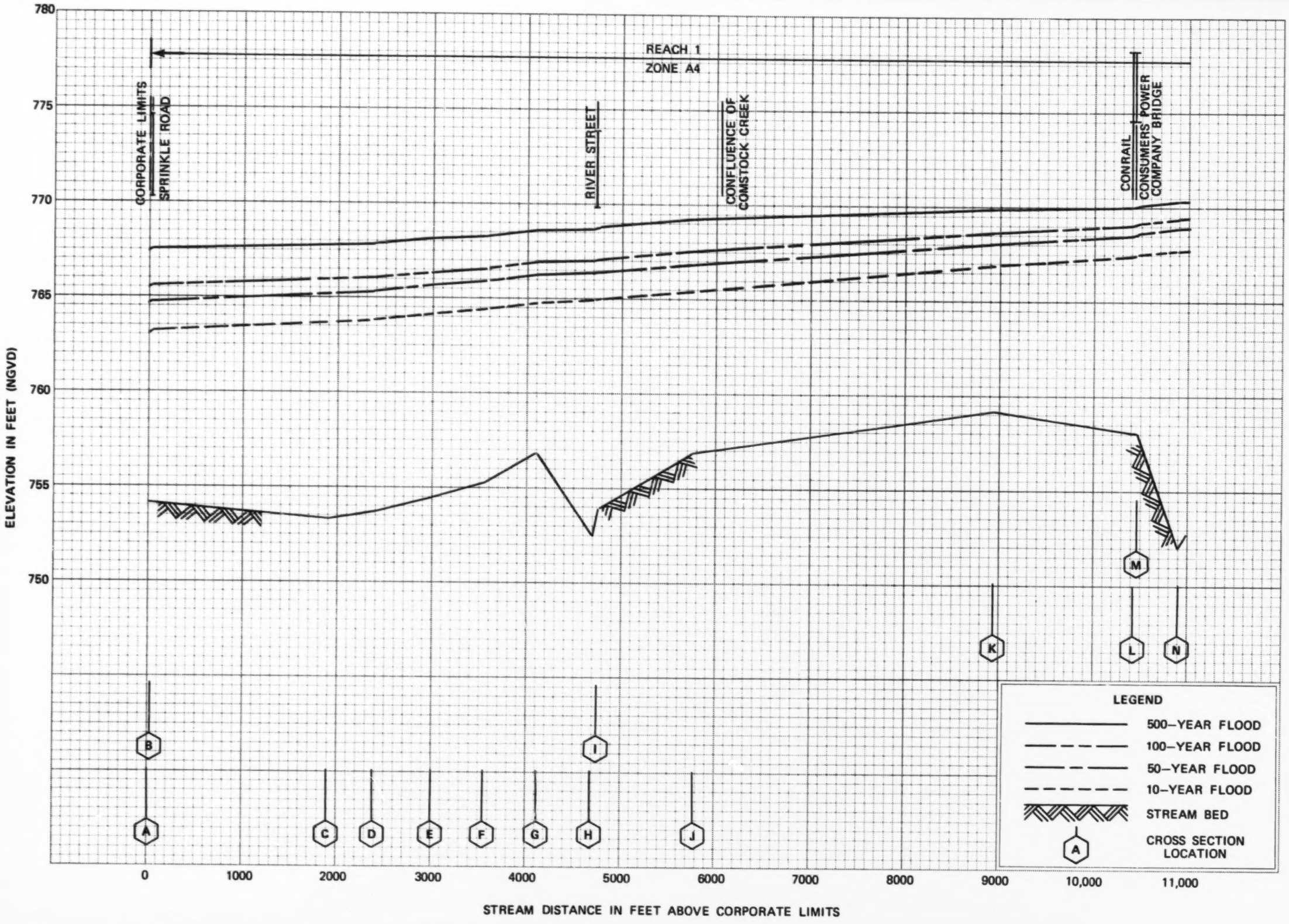

FLOOD PROFILES

KALAMAZOO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF COMSTOCK, MI
(KALAMAZOO CO.)

01P

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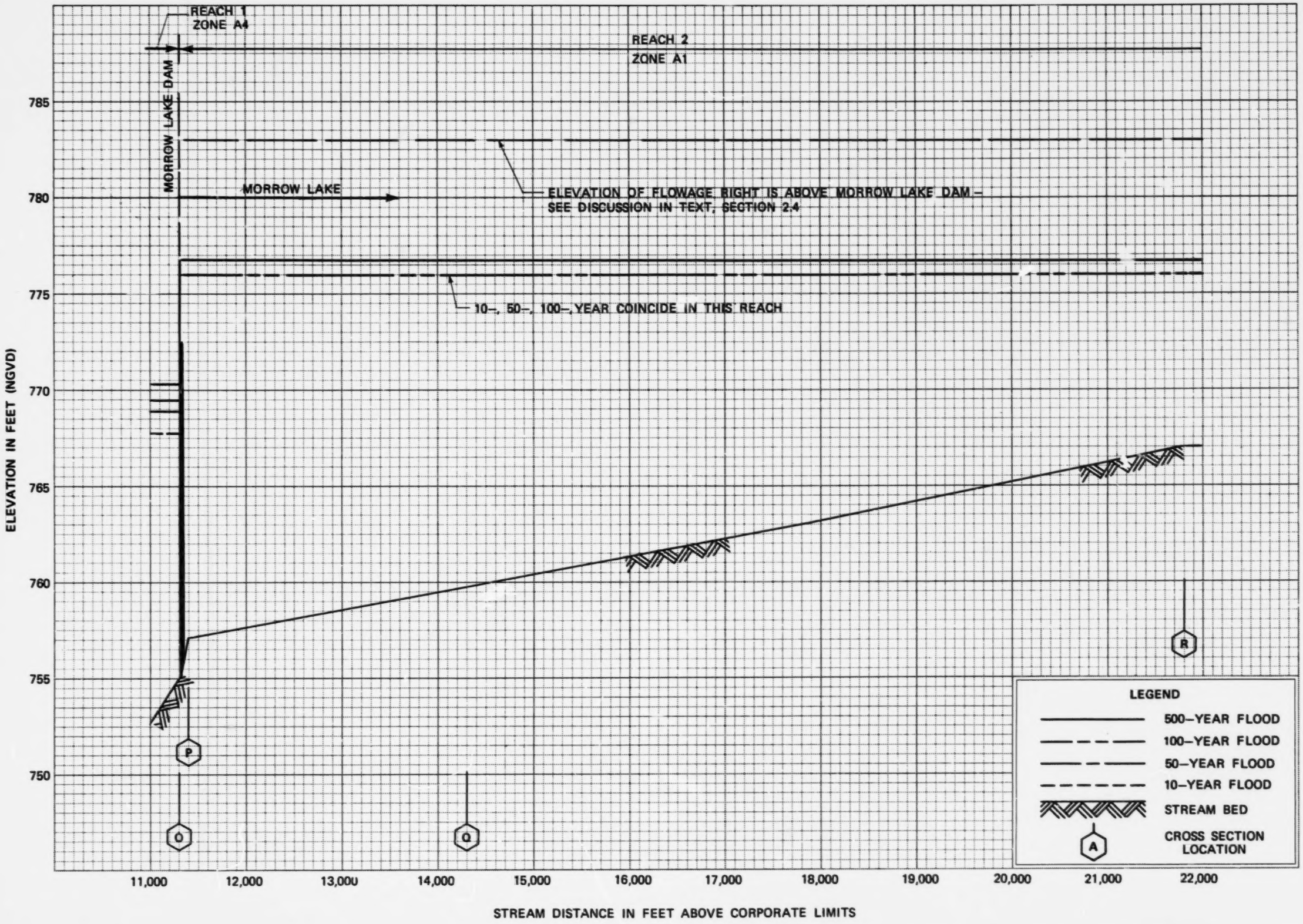

FLOOD PROFILES

KALAMAZOO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF COMSTOCK, MI
(KALAMAZOO CO.)

02P

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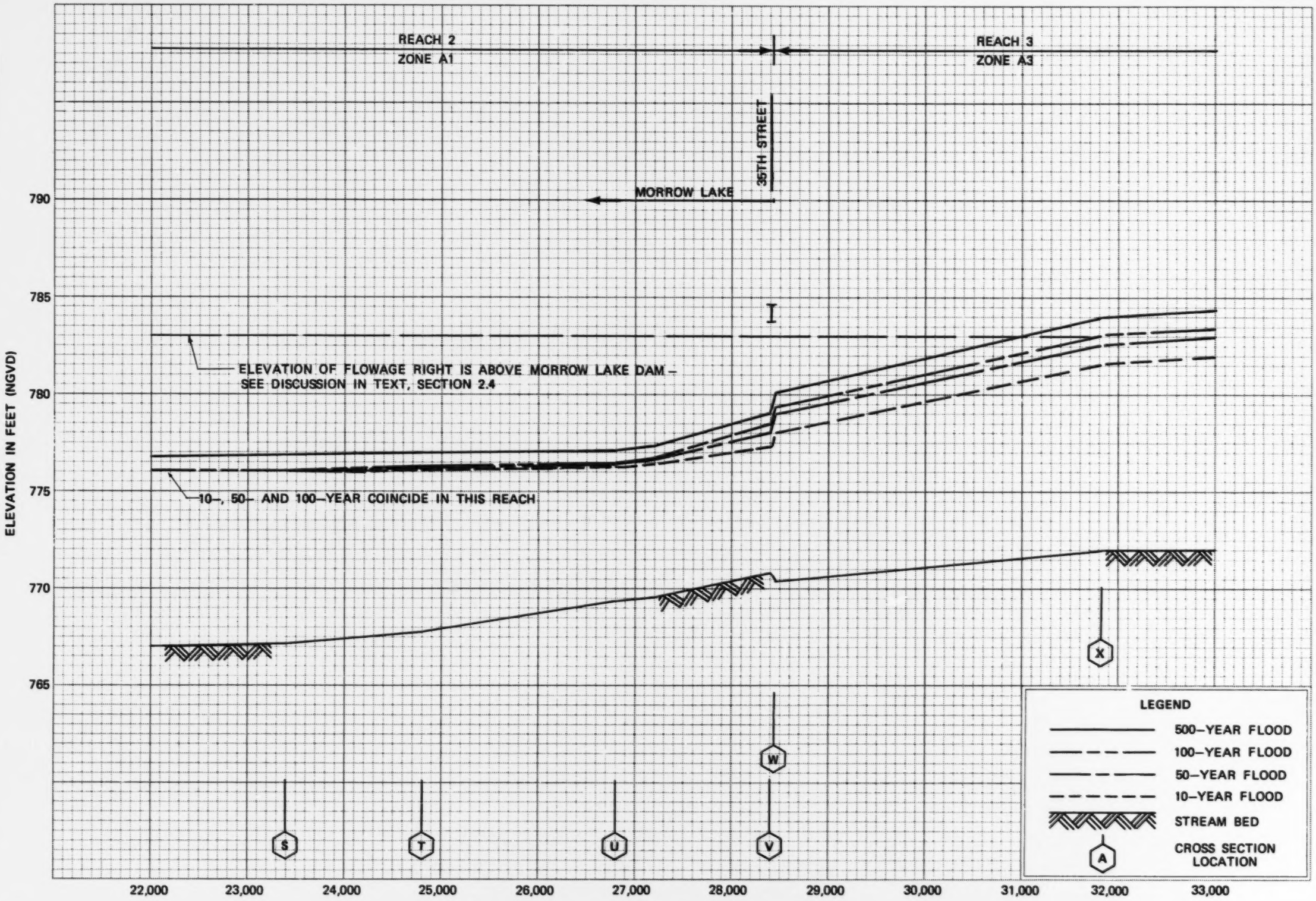

FLOOD PROFILES

KALAMAZOO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF COMSTOCK, MI
(KALAMAZOO CO.)

03P

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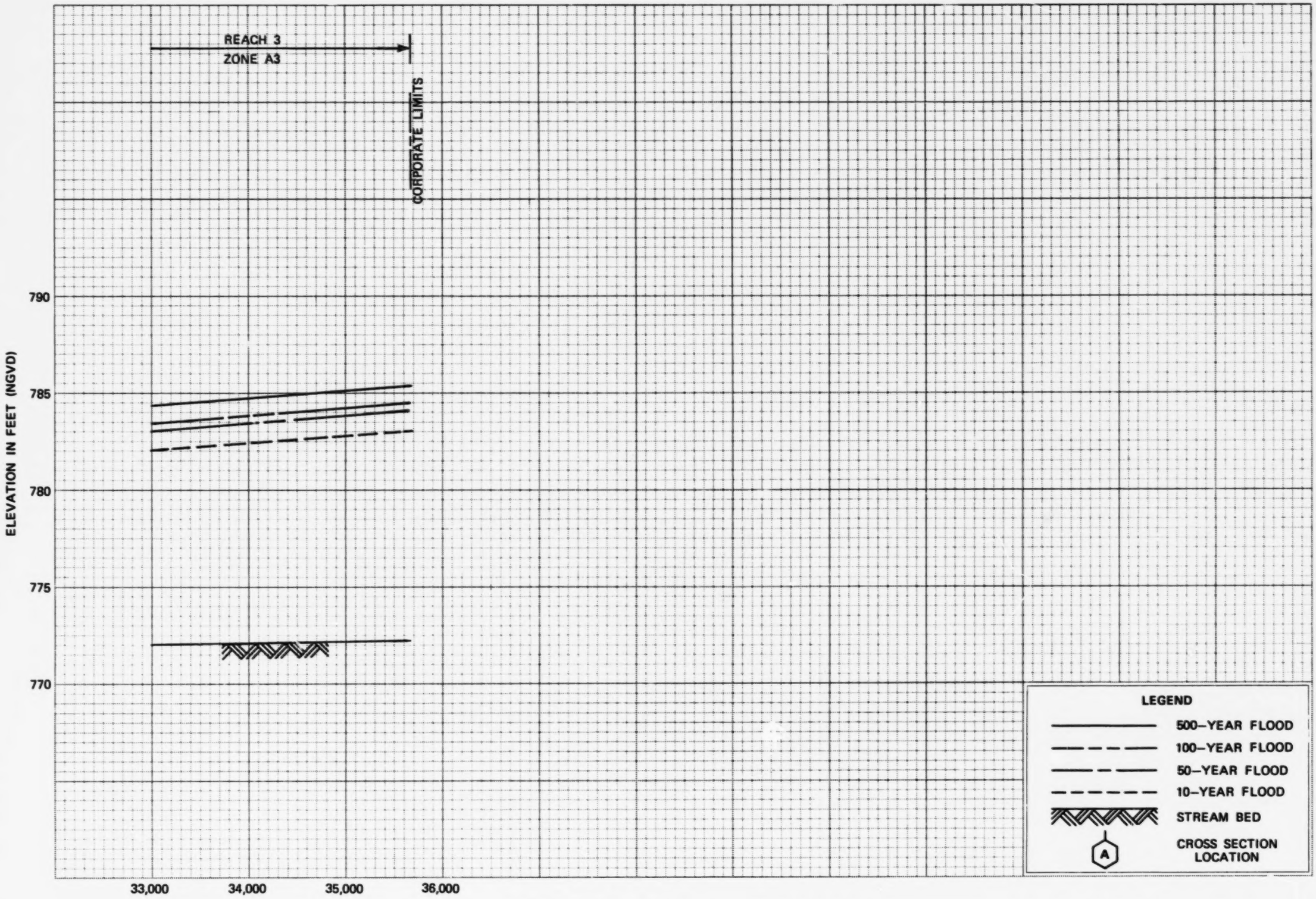

FLOOD PROFILES

KALAMAZOO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF COMSTOCK, MI
(KALAMAZOO CO.)

04P

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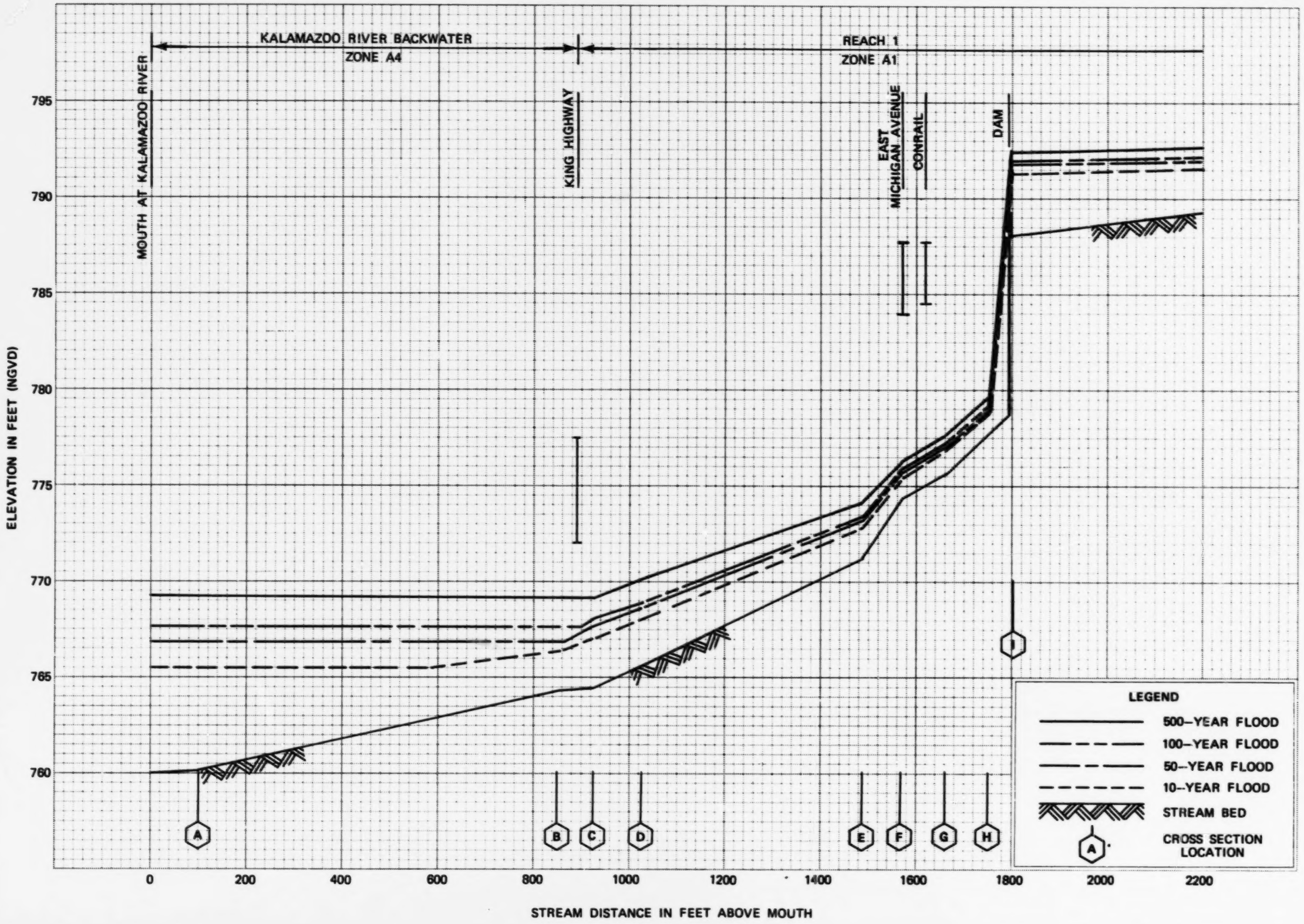

FLOOD PROFILES

COMSTOCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF COMSTOCK, MI
(KALAMAZOO CO.)

05P

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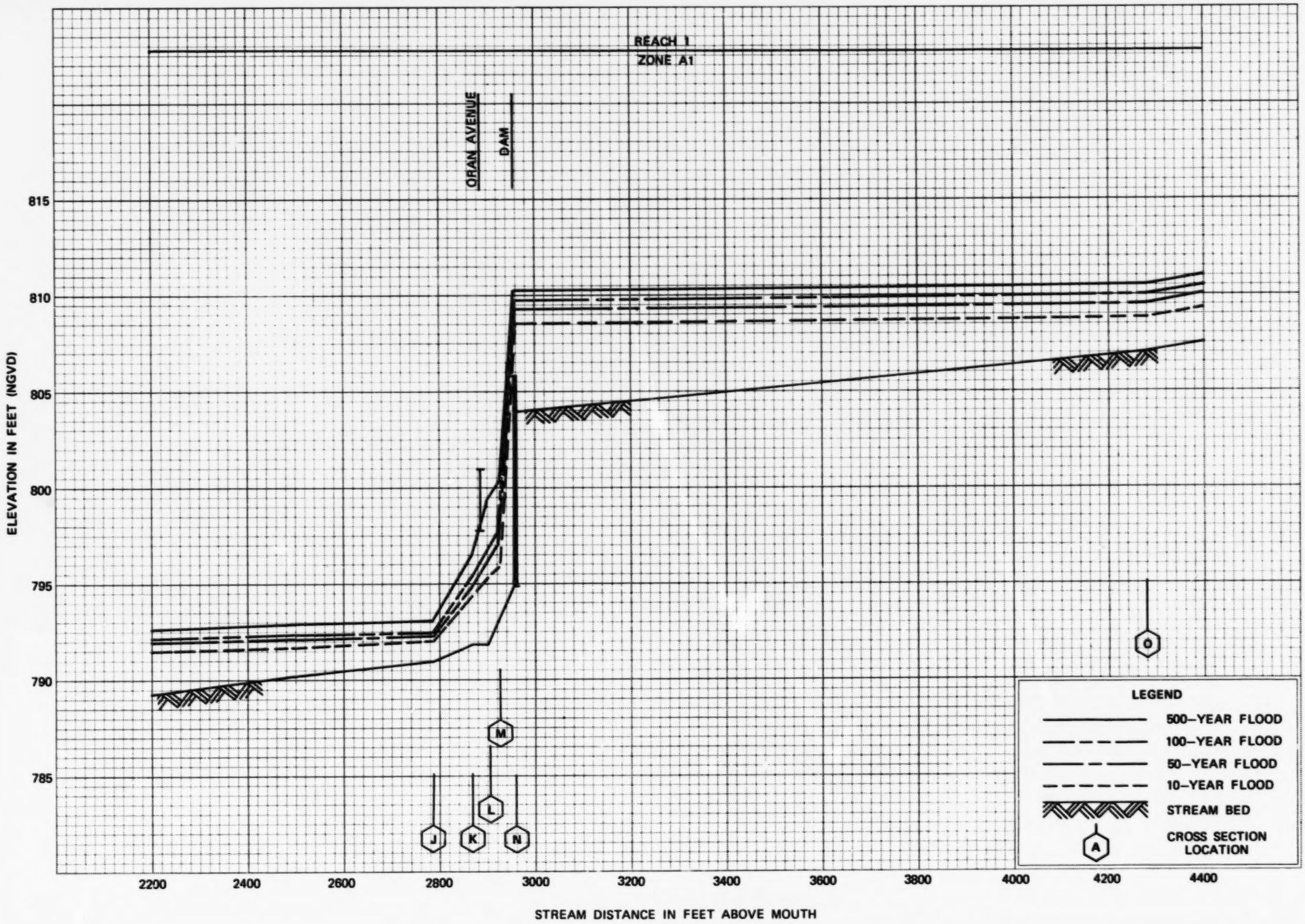

FLOOD PROFILES

COMSTOCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF COMSTOCK, MI
(KALAMAZOO CO.)

06P

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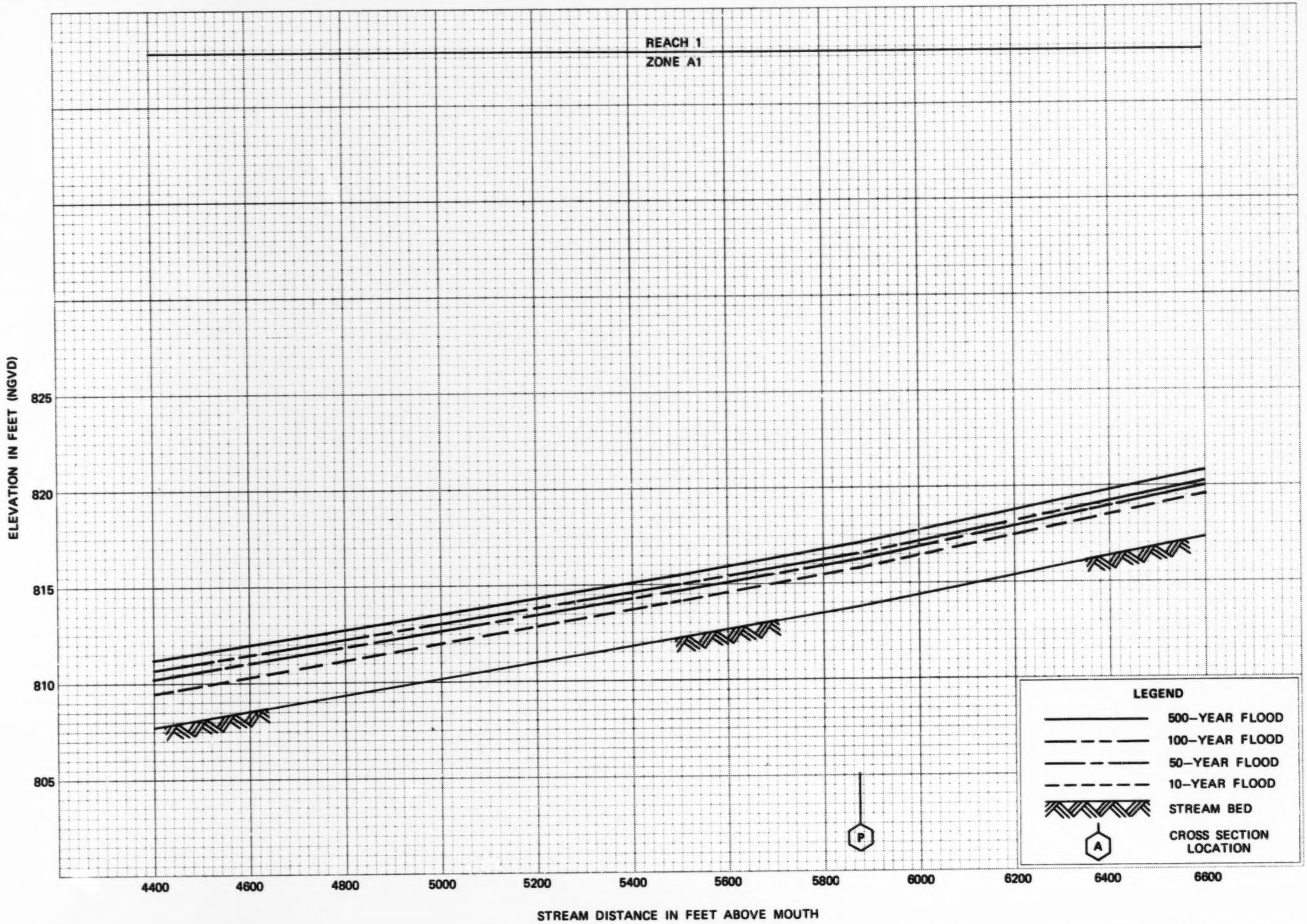

FLOOD PROFILES

COMSTOCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF COMSTOCK, MI
(KALAMAZOO CO.)

07P

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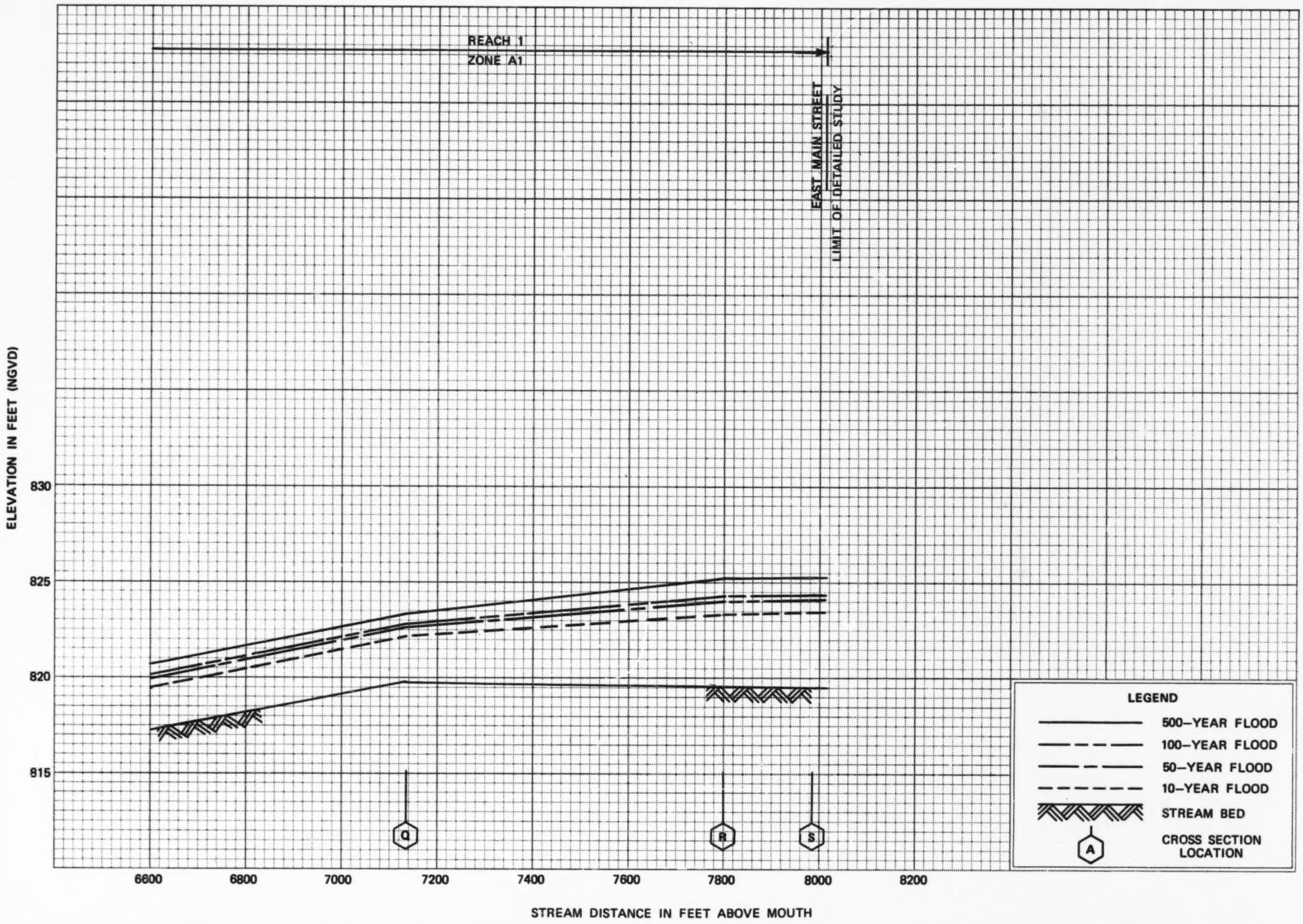

FLOOD PROFILES

COMSTOCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF COMSTOCK, MI
(KALAMAZOO CO.)

08P